
V. *A Letter from Mr.* Antony Van Leeuenhoek, *F. R. S. to* John Chamberlayne, *Eſq;* *F. R. S. Containing his Obſervations upon the Edge of Razors,* &c.

S I R,

IN your laſt acceptable Letter dated from *Weſtminſter* the 2d. of *Auguſt*, I obſerve that you deſire me to turn my Speculations, and to give you my Thoughts upon ſeveral Appearances relating to a Razor; particularly to ſay ſomething concerning its Edge and Sharpneſs, which in a good Razor is ſo fine and ſo nice, that it is ſubject to the leaſt Change and Alteration in the Weather; and particularly that Cold has ſuch an Influence upon it, as to ſpoil and blunt its Edge, inſomuch that it will hardly cut a Hair aſunder.

In anſwer to your ſaid Letter, I muſt acquaint you, Sir, that I ſhave my ſelf, and that my Razor, which I always uſe twice a Week, and which I have had above Thirty Six Years, was never Ground but twice, and yet it cuts very well; but I ſet it ſometimes upon an Oyl-ſtone or Hone, yet not as I obſerve ſome Barbers do, who ſtroke it above Twenty five Times on one ſide, and then again as many on the other; whereas I on the contrary paſs my Razor once only on one ſide, and that very gently with the Edge againſt the Stone, and then on the other ſide in the ſame manner; and ſo continue about ten or twelve Times; after that I paſs the Razor, with the Back of it downwards, upon a Leather prepar'd with *Tripoly* [which the Silver-ſmiths uſe to Poliſh or Clean their Plate with.]

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When I look upon ſuch a Razor thro' my Microſcope, I ſtand amazed at the great number of Gaps and Notches that I ſee in the Edge thereof, and wonder how one can ſhave ones ſelf ſo ſoftly therewith; nor does my Razor refuſe to do me Service even in Winter and cold Weather, tho' I muſt own at ſuch times the Shaving is a little more plainful, but that I have hitherto thought, was only occaſion'd by the Hair of the Beard being harder in Winter than Summer, when 'tis cold Weather I always keep my Razor in a Room that has Fire in it.

Now as to what concerns the Razor's becoming blunt in cold Weather, I can conceive no other Reaſon for it, but that the *materia ſubtilis*, or exceeding fine Matter, which is in all Metals, and which we may compare to Fire, is by the Cold driven out of the Edge of the Razor; by which means the Steel becomes ſo ſtubborn or hard, that in a fine Razor it makes Notches, and is blunted by the Hair. I have alſo experienced, that after having ſhaven the Beard with a fine Razor, and attempting to Cut ſome of the little Hairs in the Eye-brows, which were harder than thoſe of the Chin, notwithſtanding that they were a little ſoftned with Water, ſeveral Notches were thereby made in the ſame Razor.

I asked a certain skilful Barber, what difference he found in his Razors in very cold or hot Weather; who informed me, that when it was very Cold, he always dipt his Razors in warm Water, which made 'em cut much the better.

I have thought fit to acquaint you with the manner of my preparing my Leather upon which I paſs my Razor. My Shoe-maker furniſh'd me with a Piece of Leather, that is very ſmooth upon the ſide next the Fleſh, and of about two Fingers breadth; this I faſten'd with Glue to a thin Board of the ſame breadth, and when 'twas dry, I ſmear'd it all over with a Tallow-candle; and then I held it over the Fire a little, 'till the Greaſe had inſinuated itſelf into the Pores of the Leather, and this I repeated three times; after which I pour'd all over it a little Tripoly waſh'd clean, which I workt into the Leather with the Greaſe ſo long, 'till the Greaſe or Tallow became warm, when I pour'd on freſh, repeating that Operation four or five times, till my Smoothing-Leather was fit for uſe.

I have alſo taken fine Powder'd Emery [a Powder or Stone alſo uſed by the Silver-ſmiths to Poliſh their Plate] which I firſt ſteep'd in a little Water, and then pour'd a good deal more upon it; which having ſtir'd well together, and afterwards let it ſtand a little, I pour'd off the uppermoſt part of the Water that was impregnated with the fine Emery into another Glaſs; and after that I put a little Linnen or Woollen Rag into the aforeſaid Water, one end of which extended itſelf to the bottom of the ſaid Emery, which I ſuppoſe to remain in the Glaſs, and the other end of the Rag hung out, in order to draw off all the Water from the ſubſided Emery; which Emery being thereby become dry, I rubb'd it into the Tallow'd-Leather in the ſame manner as I had done the Tripoly before, only with this difference, that I work the Emery in with a Piece of ſmooth Ivory, or elſe with a Burniſhing-Steel; this being done, I ſtroke my Razor ſoftly over it, the Effect of which has been, that Razors, with which I have cut Wood, and which I have thrown aſide as uſeleſs, have been recover'd to ſuch a Degree, as to become fit to ſhave ones Beard again.

The aforemention'd Barber complain'd to me, that he had a Razor, which tho' it appear'd very fair to the Eye, yet was ſo ſtiff, that he cou'd bring no Edge to it, by paſſing it ever ſo often upon a Hone: I deſired him that I might look upon it thro' my Microſcope, and

and found ſeveral Notches in it; but I judg'd that it had been little uſed to a Hone, becauſe there was ſo little of it worn away, tho' he inform'd me ſince that he had ſet it above Fifty Times, but cou'd never bring it to bear.

I paſſed the ſame Razor over my Strop or Smoothing-Leather, which I had prepared with fine Emery, and then gave it him again; and a few Days after, askt him if he had made uſe of it, who told me he had, and that he had found it very good, and that in ſixteen Perſons he had ſhaved with it, he had found but one Beard that the Razor cou'd not Conquer. Now as one Razor is ſofter than another, I wou'd adviſe that the ſoft Razor ſhou'd be paſſed on a Strop that is prepared with Tripoly, and the hard one upon a Strop prepared with Emery

You ſay further, Sir, that if one cou'd diſcover the fine Particles of the Steel, of which the Sharpneſs or Edge of the Razor does conſiſt, you imagine that one might alſo be able to find out the cauſe of the very different Effects produced in the ſaid Razor.

To which I anſwer, that as for what concerns the fine Particles of Steel, as alſo Gold, Silver, *&c.* they are inconceivably ſmall: one may indeed, by the help of a good Microſcope, juſt diſcover the exceeding ſmall Particles of Gold and Silver, but one cannot perceive of what Figure they are; and who can tell of what a Multitude of Parts thoſe little Particles, which we ſee by the help of a Microſcope, are again compoſed: and although we can diſcover thoſe little Particles of which Gold and Silver are compoſed, becauſe we can diſſolve both Gold and Silver in proper Menſtrua or Waters, and can as it were unite them with thoſe Waters, and again collect thoſe Particles of Gold and Silver together, fit for our view; yet this has no Place in Iron or Steel, the fine Particles that compoſe which, we can only diſcover in the

the broken Gaps or Notches of a Razor, for inſtance; and the greater and courſer the Parts are, of which thoſe Metals are compoſed, as we may ſee in Caſt-Iron, the leſs valuable are the ſaid Metals; but the finer the Particles are, the more valuable in my Opinion will be the Steel and Iron which they compoſe.

Now when we view the ſmall broken Parts of Gold, Silver, Steel, Iron, *&c.* We muſt conſider that each of thoſe Particles, as ſmall as they appear to us, are again compoſed of a great number of other exceeding ſmaller Particles,which Nature has knit together; and that theſe coagulated Particles are yet more ſtrongly united by Fire, and after that are ſo conſolidated by the Strokes and Preſſure of the Smith's Hammer, that they ſeem to us to be but one Body, tho' they do conſiſt of a great many ſmall Particles, the courſeſt of which are always obvious when we come to break the Mettals: and how often ſoever you melt any of theſe Mettals, and break them again after they are cold, you will always be able to diſcover the grainy Particles thereof; but you will find them ſo ſtrongly joyn'd and riveted in one another, that they appear to be but one Body.

When the Steel is prepared and made into a Razor, and ſet upon a Hone, we may perceive a great many long Streaks or Scratches of the ſaid Stone upon the Razor; and the Courſer the Hone is with Sand, the Courſer and Deeper thoſe Streaks are in the Steel. They paſs the Razor thus prepared upon one Stone, oftentimes upon a finer, to the end that they may Grind out the aforeſaid long Streaks, which it had acquir'd upon the courſe Stone; for every one of ſuch Streaks in the Steel, when it is Sharpned or Ground again, becomes a Notch: when ſuch Notches are Ground out of the Razor upon a fine Oyl-ſtone or Hone, the Steel, where any of theſe Notches were, appears to the Eye as ſmooth as Glaſs; but when

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we come to view the Razor with one of our beſt Microſcopes, one may diſcover that thoſe long Streaks which cauſe the Notches, are no more taken away by the Oyl-ſtone, than when the Razor is Ground on a rough Stone; and the only difference is, that the Streaks of the former are finer than the latter: in ſhort, when one obſerves with a good Microſcope the many Notches that are in the fineſt Razor, one wou'd wonder how any of them cou'd cut ſo well. This, Sir, is all that I have to ſay to you upon the ſubject of Razors at this time.

Delft, Sept. 10. 1709.

SIR,

Your Humble Servant,

Antony Van Leeuwenhoek.